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Electronics and Communication Engineering Department NIT Hamirpur (HP)
End Semester Examination - December 2022

Semester: 9th **B.Tech ECE DD**

Sub: Modeling and Simulation of Communication System & Networks **Code: EC-665**

Max. Marks = 50 **Time = 3:00 Hrs**

Note:
1. All questions are compulsory
2. Assume suitable data whenever necessary

Q.No.1. **(A)** What is Gaussian Process? [1]

(B) Write the probability density function of multivariate gaussian distributed random variables. [2]

Q.No.2. What is the unbiased estimation of expected value for the case of non-random parameter? [5]

Q.No.3. Discuss the Bayes estimate of Random Parameters for the following type of error function:

(A) Mean-square Error.

(B) Absolute Error.

(C) Uniform cost function Error. [6]

Q.No.4. What are the Characteristics of Queuing System? Discuss it in detail. [5]

Q.No.5. Discuss the long run measures of performance of queuing system [5]

Q.No.6. Discuss the following technique for random number generation: [5]

(A) Linear Congruential Method

(B) Combined Linear Congruential Method

Q.No.7. What is additive white gaussian noise (AWGN). Find out the bit error rate (BER) of binary phase shift keying (BPSK) modulated signal for wireless communication system under AWGN. Also compare its performance with wired communication system when data modulation is BPSK, and noise is AWGN. [5]

Q.No.8. Discuss the statistics of the complex fading coefficient h in reference to wireless communication. Find out the probability density function for the amplitude and phase factor of the fading coefficient h. [6]

Q.No.9. Discuss random variate generation for Geometric distribution case by taking any suitable example. [5]

P.T.O.

Q.No.10. (189)

A real-valued Gaussian random vector $\underline{X} = [X_1\ X_2\ X_3]^T$ has a $\mathcal{N}\left(\underline{\mu}, \underline{K}\right)$ distribution, such that

$$\underline{\mu} = \begin{bmatrix} 2 \\ 4 \\ 6 \end{bmatrix}, \quad \underline{K}^{-1} = \frac{1}{(1-\rho^2)} \begin{bmatrix} 1 & -\rho & 0 \\ -\rho & (1+\rho^2) & -\rho \\ 0 & -\rho & 1 \end{bmatrix}, \quad \det\left(\underline{K}^{-1}\right) = \frac{1}{(1-\rho^2)^2}, \quad -1 < \rho < 1.$$

Let $Y_i = X_i - 4, \quad i = 1, 2, 3$. If the joint p.d.f. of Y_1, Y_2, Y_3 is given by

$$f_{Y_1,Y_2,Y_3}(y_1, y_2, y_3) = \frac{1}{C} \exp\left\{ -\frac{[y_1^2 + (1+\rho^2)\, y_2^2 + y_3^2 + 8 + A(y_1 y_2 + y_2 y_3) + B(y_1 - y_3)]}{2\,(1-\rho^2)} \right\},$$

then find A, B, C. **[5]**

**********ALL THE BEST**********